Section 102(e) Rejections

Claims 1, 3-7, 11, and 30 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,985,759 to Kim et al. ("Kim"). The standard for "anticipation" is one of fairly strict identity. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. Of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987), MPEP 2131. Kim does not disclose all limitations of the currently pending claims, some distinctive limitations of which are set forth in more detail below.

Kim does not disclose a method for fabricating a metallization structure which includes applying a sufficient bias power to splash deposited metal at the bottom of a cavity to sidewalls of the cavity. Claim 1 recites in part: "... applying a sufficient bias power to splash deposited metal at the bottom of the cavity to sidewalls of the cavity ... ." Support for this limitation may be found, for example, on page 21, lines 1-3 of the Specification, "...the sputtered metal ions may impact with previously deposited metal at the bottom of the trench with sufficient energy to resputter, or 'splash,' that metal onto lower cavity sidewalls 208." An exemplary level of a sufficient bias power is cited on page 21, lines 25-27 of the Specification as being "between 100 and 200 W. More preferably, the bias power applied to the pedestal is about 135-165 W, and is optimally about 150 W." The Office Action surmises that since Kim teaches an application of a bias power between 0 and 500 W, Kim anticipates the limitations of claim 1. On the contrary, however, a specific range of the application of bias power is not claimed in the present application. Rather, a level which is capable of producing a particular action is claimed. As such, the range of bias power included within claim 1 is not limited to the exemplary levels cited in the Specification. In particular, the range of bias power needed to splash metal from the bottom of a cavity to the sidewalls of a cavity may depend on a variety of parameters of the deposition process, such as but not limited to, the temperature and/or pressure of the deposition chamber, for example. In addition or alternatively, the size of the topography upon which a layer is deposited may affect the level of the bias power to sufficient perform such a function.

Furthermore, Kim does not teach or suggest that a bias power can be applied at a sufficient level to splash deposited metal at the bottom of a cavity to sidewalls of the cavity. On the contrary, Kim teaches that applying a high wafer bias such that a layer may be "... mostly deposited at the bottom of the contact via, rather than on the sidewalls. It is especially important to use high wafer bias (i.e., at least about –30V) with small feature size (i.e., less than 0.5 μm) contact vias." (Kim, column 9, lines 20-23). Therefore, the bias power range cited in Kim does not provide an adequate amount of specificity with

which to anticipate the limitations of claim 1. In fact, splashing deposited metal from the bottom of a cavity to its sidewalls through the application of a sufficient bias power may be deemed an unexpected result in light of the teachings of Kim.

> In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with 'sufficient specificity to constitute an anticipation under the statute.' What constitutes a 'sufficient specificity' is fact dependent. If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with 'sufficient specificity' to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious. MPEP 2131.03

In addition, Kim does not teach or suggest ion metal depositing a wetting layer consisting essentially of titanium upon and in contact with the base and sidewalls of a cavity within a dielectric layer and subsequently sputter depositing a bulk metal layer upon and in contact with the wetting layer. Claim 30 recites:

> A method for fabricating a metallization structure, comprising: etching a cavity comprising a base and opposing sidewalls within a dielectric of a topography; ion metal plasma depositing a wetting layer consisting essentially of titanium on and in contact with the base and the sidewalls of said cavity; and sputter depositing substantially an entirety of a bulk metal layer on and in contact with the wetting layer.

Support for such a claim may be found, for example, on page 5, lines 4-8 of the Specification, "[t]he method preferably includes ion metal plasma depositing a wetting layer within a cavity defined in a dielectric layer. The wetting layer preferably includes titanium. The method preferably further includes sputter depositing a bulk metal layer within the cavity and upon the wetting layer." Additional support may also be found in Figs. 6-8 and accompanying text of the Specification.

Kim discloses depositing a number of wetting layers within contact via 10 prior to the deposition of aluminum 28. However, not all of the wetting layers consist essentially of titanium. In fact, Kim specifically teaches depositing a titanium nitride layer within the contact via to serve "... as the main barrier layer to prevent migration of silicon to the top of the barrier structure..." (Kim, column 8, lines 31-32). In addition, Kim teaches depositing an oxygen-stuffed titanium layer "... in order to improve the effectiveness of the titanium and/or titanium nitride as a barrier layer. The presence of oxygen in the titanium matrix disrupts the formation of channels through which mobile silicon atoms can travel." (Kim, column 8, lines 13-17). As such, Kim does not teach ion metal depositing a wetting layer consisting essentially of titanium upon and in contact with the base and sidewalls of a cavity and subsequently

sputter depositing a bulk metal layer upon and in contact with such a wetting layer. Furthermore, there is no motivation within Kim to use such a fabrication method since Kim specifically teaches depositing wetting layers which include oxygen and/or nitride in combination with titanium in order to improve the effective barrier properties of the contact structure.

For at least the reasons cited above, claims 1 and 30 are not taught or suggested by Kim. Therefore, claims 1 and 30, as well as claims dependent therefrom, are asserted to be patentably distinct over Kim. Accordingly, removal of the 102(e) rejection of claims 1, 3-7, 11 and 30 is respectfully requested.

Section 103 Rejections

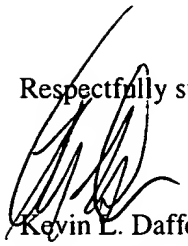
Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of U.S. Patent No. 6,045,666 to Satitpunwaycha et al. ("Satitpunwaycha"). Claim 8 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of U.S. Patent No. 6,217,721 to Xu et al. ("Xu '721"). Claims 9 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of U.S. Patent No. 5,371,042 to Ong ("Ong"). As noted above, claim 1 is patentably distinct from Kim. In addition, Kim cannot be combined with Satitpunwaycha, Xu '721, or Ong to overcome the deficiencies therein to teach the limitations of claim 1. In particular, neither Satitpunwaycha, Xu '721, nor Ong teach or suggest applying a sufficient bias power to splash deposited metal at the bottom of a cavity to sidewalls of the cavity. As such, no combination of the cited art can teach or suggest the limitations of claim 1. Consequently, claim 1 and claims dependent therefrom, are patentably distinct over the cited art. Accordingly, removal of the § 103(a) rejection of claims 2 and 8-10 is respectfully requested.

CONCLUSION

This response constitutes a complete response to all issues raised in the final Office Action mailed August 30, 2002. In view of the remarks traversing the rejections, Applicants assert that pending claims 1-18, 22, 23, and 30 are in condition for allowance. If the Examiner has any questions, comments, or suggestions, the undersigned attorney earnestly requests a telephone conference.

No fees are required for filing this amendment; however, the Commissioner is authorized to charge any additional fees, which may be required, or credit any overpayment, to Conley, Rose & Tayon, P.C. Deposit Account No. 50-1505/5298-03500.

Respectfully submitted,



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Date: December 2, 2002
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ATTACHMENT A
"Marked-Up" Amendments

IN THE SPECIFICATION

Please amend pg. 20, line 22 - pg. 21, line 7, as follows:

To resolve these problems, the present method is preferably configured to deposit metal atoms with sufficient force to sputter previously deposited metal away from the ion impact area. The impact energy of the metal ions on the microelectronic topography is largely determined by the pedestal bias. A greater pedestal bias will increase the energy with which the ionized metals impact the deposition surface. The present process preferably incorporates a pedestal bias configured to deposit metal atoms with sufficient force to sputter previously deposited metal and reduce or prevent the problems discussed above. This feature allows for sputtering away of excess material on the tapered sidewall portions, and thus helps to prevent shadowing of other cavity sidewall portions. In addition, the sputtered metal ions may impact with previously deposited metal at the bottom of the trench with sufficient energy to resputter, or "splash,"[,] that metal onto lower cavity sidewalls 208. The pedestal bias, however, is preferably not set so high as to sputter away too much of the deposited material from areas that receive the greatest amount of direct ion impact (e.g., tapered portions 210 of the cavity sidewall and cavity base 206). In particular, the pedestal bias is preferably set below a level that would result in thinning of the wetting layer upon the tapered portions of the cavity sidewalls.